BRIEFER ARTICLES.

Accessory Buds.—*With Plate XIV.*—The axillary buds of *Spiraea sorbifolia* L. are very conspicuous and are especially interesting because of the pair of large collateral accessory buds which are usually associated with them. There is no better plant than this for studying the nature of accessory buds, if taken when these buds are just making their appearance, say in June or July. During the winter the three buds seem to have no connection with one another, but when small the accessory buds are plainly seen to arise from the axils of the first two bud-scales of the axillary bud. (Fig. 1.) Occasionally only one accessory bud makes its appearance, and sometimes when both accessory buds are present the normal axillary bud aborts and results in apparently two axillary buds entirely separated from one another.

No other Spiræa examined had accessory buds, but other species belonging to the order Rosaceæ were examined, and wherever accessory buds occurred they were collateral with the axillary buds, and evidently axillary to the lower bud-scales.

In a cultivated species of cherry some of the nodes have simple axillary buds while others have one or more accessory buds of equal or almost equal size with the axillary bud; but as between these two conditions there was every degree of development present. The origin of the accessory bud was plainly seen to be the same as those of Spiræa.

There are no accessory buds on the wild cherry (*Prunus serotina* Ehrh.), but on examination of the rings left by the falling of the bud-scales at the beginning of this year's growth a small bud is seen in each of the lower scars. These buds would have been the accessory buds had they been conspicuously developed during the existence of the bud to whose scales they are axillary.

Accessory buds in Caprifoliaceæ, when present, are superposed and their character, if the same as in rosaceous plants, is not so apparent. *Diervilla trifida* Moench. gives excellent examples of this arrangement of the buds (fig. 3). Here two buds appear above each axillary bud and in case the axillary bud is in any way destroyed, the lower accessory on that side increases in size till it is equal to the axillary bud of the opposite side (fig. 4). The same arrangement is also found in several cultivated varieties of honeysuckle, as *Lonicera Halliana* L., *Japonica* and var. *aurea*, etc., while our native honeysuckle (*L. Sullivantii* Gray) has no accessory buds.

In all the representatives of the Leguminosæ examined where accessory buds are present, the axillary bud is removed a short distance above the axil of the leaf and a single accessory bud is situated in the axil. This is distinctly seen in *Amorpha fruticosa* L. and *Cercis Canadensis* L. In the honey locust (*Gleditschia triacanthus* L.) the thorns are somewhat removed from the axils and a small bud is situated in the axil of the leaf. It is thus evident that the thorns arise from the true axillary buds and the small bud in the axil of the leaf is an accessory bud.

In Vitaceæ is found another very striking proof that accessory buds are not anomalous in character but are axillary to the bud-scales or the undeveloped leaves in the bud. Here a glance at any of the buds will show a single accessory bud with the apex just apparent above the outer bud-scale. This is best seen in *Ampelopsis quinquefolia* Mx. No one would, from a superficial examination, suppose more than this one accessory bud to exist, but by sectioning the bud one and frequently two other such buds may be seen in different stages of development (fig. 10).

August F. Foerste has observed[1] a tendency of certain abnormal conditions to recur at more or less regular intervals in a specimen of elm studied by him. Much greater regularity is shown in the recurrence of definite nodal characters in Ampelopsis. The repeated series consists of three nodes beginning with the third node from the axis from which any ramial division in question arises. At the first node of this series we observe on one side the stem nothing but the leaf-scar, on the opposite side the remains of a tendril, a flower-cluster, or the scar left by the falling of one or the other of these. The second node of the series is frequently precisely similar to the first but on vigorous branches usually presents a compound bud in the axil of the leaf-scar. At the third node of the series there is no scar or organ opposite the leaf-scar while in its axil is a strong axillary bud with its accessories well developed.

There seems to be a gradual increase of power from the first to the third node of the series. At the first node the terminal bud produces either a tendril or a flower-cluster which becomes opposed to the leaf by the development of the axillary bud into the succeeding internode of the axis, and the accessory bud fails to appear. At the second node sufficient power may have developed to produce in addition to these an accessory bud in the position usually occupied by the axillary bud. This bud does not materially differ from the true axillary bud except in the degree of development. A section of it shows the two or three accessory buds within but they are not as far ad-

[1] Botanical Gazette **19**: 463. 1894.

vanced as the accessories of the true axillary bud. In the third node where the energy seems to reach a climax the terminal bud produces the succeeding internode and the remainder of the power is spent in forming and protecting a strong bud whose destiny is to develop a secondary axis the following season. The year's growth never ends with an uncompleted series, the crowning bud always belonging to the third node.

The wild grape (*Vitis cordifolia* Mx.) is precisely similar to Ampelopsis in all these characters, but in the cultivated varieties examined considerable variation was found to exist in the periods of recurring nodal characters. The node at which the terminal bud continues the main axis occurred in these varieties at intervals of three, five, seven or even nine, and though usually at odd intervals would sometimes occur in the fourth or sixth places. This variation is probably due to the unnatural conditions attendant upon cultivation, especially such as pruning.

Prof. Alphonso Wood considered[2] the tendrils of the grape abortive or transformed flower-stalks. This is not necessarily true. Both are axial developments arising from terminal buds and hence occupy similar positions, but it is no more correct to say the tendrils are abortive flower-clusters than that the flower-clusters are modified tendrils, which latter would be the more probable if either were true, because tendrils are produced during the entire growing season while flower-clusters appear for a very short interval only.

The accessory bud of *Juglans nigra* L. and species of Carya is very small and arises just below the axillary bud in the groove at the base of the petiole. Observations thus far indicate that the relative position of axillary and accessory buds forms a family character. Though *Juglans cinerea* L., being rather rare in this section, has not come under the observation of the writer, it seems to him a fair question whether Prof. Asa Gray may not be mistaken in stating[3] that in the butternut "the true axillary bud is minute and usually remains latent, while the accessory ones are considerably remote and the uppermost which is much the strongest, is far out of the axil; this usually gives rise to an extra-axillary branch." In no observed case are branches regularly produced by accessory buds, their office being simply to take the place of the axillary bud in case that is destroyed, or normally develops into some other organ, as do the axillary buds of Diervilla, which develops the fruit.

Possibly the upper and stronger bud in the butternut which usually

[2]Class Book of Botany 66, 75. 1880.
[3]Gray's Botanical Text Book. 1: 45. 1879. [6th ed].

"gives rise to an extra-axillary branch" is the true axillary bud, as the upper bud plainly is in Amorpha fruticosa, Cercis Canadensis, and the above mentioned Juglandaceæ.—GEO. H. SHULL, *Sulphur Grove, Ohio.*

EXPLANATION OF PLATE VI.—Fig. 1. Axillary bud of *Spiræa sanguisorba* L., the accessory buds just making their appearance.—Fig. 2. Same, the axillary buds fully developed as seen in the winter.—Fig. 3. A node of *Diervilla trifida* Moench.—Fig. 4. The same. One of the axillary buds has been destroyed and the leading accessory bud has taken its place.—Fig. 5. A node of *Cercis Canadensis* L.—Fig. 6. A node of *Amorpha fruticosa* L.—Fig. 7. Node and thorn of *Gleditschia triacanthus* L.—Fig. 8. A node of *Juglans nigra* L.—Fig. 9. A node of *Ampelopsis quinquefolia* Mx.—Fig. 10. A section of the bud of same.—Fig. 11. The first two nodes and the recurring series of three nodes of *Ampelopsis quinquefolia.*

Relations of cutinized membranes to gases.—During the course of some experiments on the relations of plant membranes to gases, I had occasion to make an estimation of the rate of diffusion of CO_2 through a grape skin, and obtained a somewhat unusual result. In this experiment a cleaned skin of a Concord grape was fitted, by means of sealing-wax, to one end of an open glass tube 30^{cm} in length and 5^{mm} internal diameter, filled with boiled water, inverted in a dish of mercury, and the water displaced by washed carbon dioxide (MacDougal, Exp. Plant Physiology 36, 37. 1895). By the exosmose of the gas the mercury column was slowly drawn upward into the tube, for seven days at the rate of 2.5^{cm} per day, and six days at the rate of 1^{cm} per day. At the end of this time the meniscus of the mercury column was against the lower surface of the membrane. The column remained stationary for eleven days and then slowly began to fall until ten days later it became stationary 1^{cm} below the membrane. It retained its height with barometric and thermometric variations, from Nov. 1, 1894, to Dec. 10, 1895, when the apparatus was accidently shaken so roughly that the vibration of the mercury column ruptured the membrane and the column fell in a few minutes. An examination of the grape skin revealed a heavy cutinization of the outer walls as well as in the ten to fifteen layers of cells of which it is composed. The inner layers of the epidermis in some instances showed intercellular spaces, so that only the extreme outer layers can be taken into account in the consideration of the resistance to filtration, which in the present instance lasted thirteen months under pressure of 29^{cm} of mercury. This absolute resistance of the membrane to filtration for such a length of time has not been duplicated in any case whose records are accessible to the writer. Miss Golden details experiments with the resistance of grape skins to filtration under pressure of 44.5^{cm} of mercury for nine days (Proc. A. A. A. S. 43: 277. 1895.) and Wiesner